



**Wisconsin Highway Research Program  
Request for Proposal for**

**Performance of Pile Supported Sign Structures**

**Questions regarding the content of this RFP are due no later than  
4:30 PM (CST), Monday, December 10, 2012**

**Responses to questions will be posted to the WisDOT Research and Library website  
(<http://wisdotresearch.wi.gov/rfps-and-proposals>) by  
4:30 PM (CST), Monday, December 17, 2012**

**Proposers must submit an electronic version of a proposal (Adobe PDF required) by  
4:30 PM (CST), Friday, January 25, 2013  
to [apakes@sustainability.wisc.edu](mailto:apakes@sustainability.wisc.edu)**

**For further information regarding this RFP contact:  
Angela Pakes Ahlman  
email: [apakes@sustainability.wisc.edu](mailto:apakes@sustainability.wisc.edu)**

**Researcher Questions on RFP**

Please refer all questions on this RFP to the WHRP Technical Director, Angela Pakes Ahlman by the aforementioned due date. Questions must be in writing. No response will be provided to questions received after the due date.

**Researcher Proposal Preparation Guidelines**

WHRP Proposal Guidelines are available on the WisDOT Research and Library website (<http://wisdotresearch.wi.gov/wp-content/uploads/WHRP-RFP-Guidelines-11-26-12.pdf>).

Please refer to these instructions in preparation of your response.



**Wisconsin Highway Research Program  
Request for Proposals  
Geotechnical Technical Oversight Committee**

**Title**

**Performance of Pile Supported Sign Structures**

**I. Background and Problem Statement**

The purpose of the research is to evaluate the performance of pile supported sign structures as a result of wind loads. Typically, sign structures are supported by drilled shaft foundations or spread footings foundations. However, when the soil conditions are not suitable to be supported on drilled shafts or spread footings, a group of piles could support the foundation. Large sign structures are subject to large lateral wind loads, which result in large lateral forces and overturning moments. These lateral forces and overturning moments produce both uplift loads and downward loads on the pile foundation. The AASHTO ASD requirements indicate that these uplift loads can be resisted by the smallest of the following three different methodologies:

- The skin friction on one pile multiplied by the number of piles divided by a factor of three
- The effective weight of the soil located within the perimeter of the piling times two divided by three.
- The effective weight of the soil located within the perimeter of the piling divided by two, plus the shear strength of the soil perimeter divided by two.

However, it is unclear what the uplift loads should be to compare to the pile group resistance or how the overturning loads are shed from one pile to the next pile.

**II. Scope**

This research project can be divided into four phases. The first phase will be to conduct a thorough literature search of any similar-type studies that may have been completed. This search will also include gathering other background data/studies that would have applicability to this research (including other state DOT's practices).

The second phase of the work will be to develop and implement a work plan for evaluating and field-testing the performance of at least two pile foundations for sign structures. It is expected that some initial modeling of the soil/pile interaction will be performed prior to performing the field tests. The work plan should at minimum evaluate a relatively short length of 10 x 42 H-piles and a relatively short length of 10 ¾-inch diameter cast-in-place piles. The length of the piles should be long enough to force the point of overturning above the tip of the piles. The spacing for a four H-pile configuration is shown in Figure 1.

At minimum, the field tests should monitor the lateral force, the load within the foundation, the uplift load over the length of the piles, and the compression load over the length of the piles. The subsurface conditions for the test site should allow the pile(s) to yield upward during the



applied lateral loads. The reinforcement in the foundation and the stem should be adequate to force the failure within the pile/soil interface.

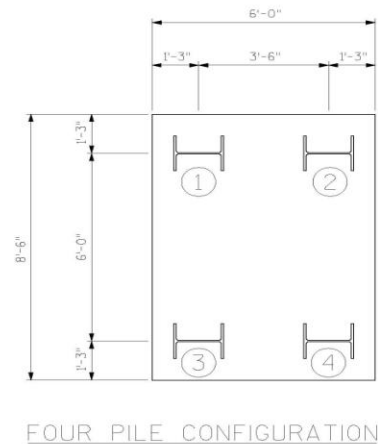


Figure 1: Layout for sign structure

The third phase will involve evaluation of the data, the calibration of the model and provide guidance for the foundation support of pile supported sign structures.

The fourth phase of work will require presenting all the data, findings, analyses and recommendations in a final report and presentation to the Technical Oversight Committee.

### **III. Specific Results, Findings, Tools, etc.**

The following presents the findings from research.

- Results of the lateral load tests on a minimum of two sign structures foundations to evaluate the reaction to the uplift loads caused by a simulated wind load.
- Develop and evaluate a model that demonstrates how sign-supported foundation piles react to the lateral wind load.
- Calibrate the model based on the field test evaluations
- Provide recommendations with respect to the current state of practice of WisDOT's pile supported sign structures.

A final report documenting all research findings and conclusions will be required. Implementation of findings will be conducted by WisDOT, as appropriate.

### **IV. Length of Research Project and Approximate Cost**

It is estimated that the time required for the four phases of the project should not exceed 18 months. The draft final report should be submitted in electronic format after month 15 to



accommodate TOC review, scheduling of the final presentation and incorporation of review comments in the final report. The researcher will deliver eight paper copies of the final report, along with an electronic version. The cost is estimated to be \$100,000. As part of the researcher selection criteria, the TOCs will evaluate the time and cost estimates in the submitted research proposals.

**V. Urgency and Potential Benefits**

WisDOT transportation facilities often require piles for support the foundation for sign structures. The study would provide guidelines for the design of pile-supported sign structure foundations.

**VI. Additional Requirements for Implementation**

Results from this study will provide the WisDOT with information for evaluating the pile supported foundations for sign structures. The researcher will provide recommendations for the design of pile supported foundations for sign structures, but the actual design changes will be the responsibility of the WisDOT.